V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Human Health, Nutrition and Well-being

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
202	Plant Genetic Resources	5%	0%	15%	25%
206	Basic Plant Biology	5%	0%	15%	0%
502	New and Improved Food Products	10%	10%	15%	25%
701	Nutrient Composition of Food	10%	10%	10%	25%
702	Requirements and Function of Nutrients and Other Food Components	10%	10%	10%	25%
703	Nutrition Education and Behavior	15%	20%	0%	0%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	10%	15%	5%	0%
721	Insects and Other Pests Affecting Humans	10%	5%	10%	0%
722	Zoonotic Diseases and Parasites Affecting Humans	5%	5%	10%	0%
724	Healthy Lifestyle	10%	15%	10%	0%
802	Human Development and Family Well-Being	10%	10%	0%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	4.0	50.0	6.0
Actual Paid Professional	68.0	10.0	32.0	6.0
Actual Volunteer	15.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
374941	500747	413820	208415
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
374941	466136	413820	76185
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2886359	3947	3211712	542193

V(D). Planned Program (Activity)

1. Brief description of the Activity

Human nutrition, health and well-being research and outreach programs will include, but not be limited to, the concepts listed below:

The Plants for Human Health Institute at Kannapolis, NC aims to enhance the nutritional value of fruits and vegetables and related compounds to improve human health and prevent disease. One of their first major accomplishments, collaborating with the David H. Murdock Research Institute and a nationwide consortium, is the sequencing of the blueberry genome, a major fruit when fresh fruit consumption and antioxidants for health are considered. Associated with the Institute, the NC Market Ready outreach program will provide information to growers and marketers for business management, marketing, safety and production management to facilitate the introduction and production of new crops evolving from the Institute's research efforts. Studies examine ways to identify and control tick species that vector Rocky Mountain Spotted Fever. A novel approach involved an all-natural botanical insect repellant for both ticks and mosquitoes. Biochemical research is developing technologies to produce effective vaccines against insect vectored diseases. Biochemists are seeking to understand ribosomal RNA targets for antibiotics in an effort to understand why antibiotics lose their effectiveness, ways to enhance the effectiveness of existing materials and possibly find new antibiotics with enhanced effectiveness or new modes of action. Also researchers are looking at the various potential uses of biofilms associated with bacterial masses, including the possibility of inactivating biofilms associated with disease causing organisms, making them susceptible to existing or new antibiotics or other antibacterial compounds. Geneticists are seeking to understand relationships between genetic makeups of animals and based on that, how environmental influences (chemicals, toxicants, food compounds) might influence cancer development. Outreach with partner and interested life sciences communities, the food and pharmaceutical industries and peer scientific communities provides new technologies and scientific information which may become the basis of startup or existing manufacturing companies.

2. Brief description of the target audience

Peer researchers and collaborators, including health care providers
Food processors and manufacturers
Farmers and growers
Consumers
Allied technical service providers and consultants to growers, processors and marketers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012

Actual: 10

Patents listed

US patent No. 8,211,485- Process For Preparing Hypoallergenic and Non-allergenic Peanuts (Arachis Hypogaea) Utilizing An Endopeptidase

Lactobacillus Acidophilus Nucleic Acid Sequences Encoding Carbohydrate Utilization-Related Proteins and Uses Thereof(Europe)

Polymer Based Nanofibers Impregnated with Drug Infused Plant Virus Particles as a Responsive Fabric for Therapeutic Delivery

Lactobacillus Acidophilus Nucleic Acid Encoding Fructo-Oligosaccharide Utilization Compounds and uses Therof

A process for the modification of plant viral capsides for use as a therapeutics delivery vessel

Modulation of BfmR by Imidazole-based Anti-biofilm Agents

Methods of Reduce Polyposis and Colorectal Cancer

Lactobacillus Acidophilus Nucleic Acid Sequences Encoding Carbohydrate Utilization-Related Proteins and Uses Thereof(Australia)

Methods of Preparing Cyclic Peptides and Uses Thereof

Lactobacillus Acidophilus Nucleic Acid Sequences Encoding Carbohydrate Utilization-Related Proteins and Uses Thereof(US)

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	19	122	141

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Non-degree credit group activities conducted related to human health, nutrition and well-being

Year	Actual
2012	4101

Output #2

Output Measure

- Targeted audiences participate in workshops and demonstrations on human health, nutrition and well-being

Year	Actual
2012	128781

Output #3

Output Measure

- Conduct research projects related to human health, nutrition and well-being

Year	Actual
2012	50

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Identify and develop new food constituents or compounds that can benefit human health or nutrition
2	Create new plant materials (germ plasm, breeding lines, cultivars) that contain health benefiting compounds
3	Research projects generate findings that impact the knowledge of and control of vectors that impact human health and safety
4	Research projects generate findings that impact the knowledge of prevention or curing of diseases influenced by interactions of genetics and the environment

Outcome #1

1. Outcome Measures

Identify and develop new food constituents or compounds that can benefit human health or nutrition

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Plant based food constituents are finding a place in diets or dietary supplements for humans to help maintain health prevent diseases.

What has been done
Working with General Mills, NCSU researchers genotyped a broccoli population developed at NCSU with more than 5,000 Single Nucleotide Polymorphic (SNP) markers that were developed from genomic scaffolds of rapeseed (canola).

Results
This mapping has been used to identify a single gene in broccoli that could double the amount of lutein found in broccoli. This finding led to a funded collaboration with the Monsanto Company to evaluate the transferability of this characteristic to elite broccoli material. If this is successful, it will lead to a product that will impact consumers that suffer from age-related macular degeneration and cataracts.

4. Associated Knowledge Areas

KA Code	Knowledge Area
206	Basic Plant Biology
502	New and Improved Food Products
701	Nutrient Composition of Food
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Create new plant materials (germ plasm, breeding lines, cultivars) that contain health benefiting compounds

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Increased emphasis is being placed on the importance of fruits and vegetable in the human diet, both for providing traditional nutrients, but often to provide antioxidants and other materials shown to enhance health and help prevent diseases.

What has been done
Plant breeders are working with chemists, basic geneticists and scientists working with biobased products to develop new breeding materials and eventually plant varieties that will carry beneficial nutraceuticals to consumers of these fruits and vegetables.

Results
Efforts continue with broccoli, cabbage, blueberries, muscadine grapes and tomatoes to create breeding lines and varieties that produce and provide a variety of beneficial antioxidants and other materials known to impact human health.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
206	Basic Plant Biology
502	New and Improved Food Products

Outcome #3

1. Outcome Measures

Research projects generate findings that impact the knowledge of and control of vectors that impact human health and safety

2. Associated Institution Types

- 1862 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	12

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Emerging foodborne pathogens have become a major public health concern. Many naturally occurring compounds found in medicinal plants, herbs, and spices have been shown to possess antimicrobial activities against many foodborne pathogens. The enterohemorrhagic Escherichia coli strain O157:H7 is a major bacterial foodborne pathogen. Cattle are considered to be the major reservoir for E. coli O157:H7, and approximately 80% of herds (beef and dairy) may be affected. Synthetic antibiotics provide the main basis for the therapy of bacterial infections. However, overuse of antibiotics has become the major factor for the emergence and dissemination of multi-drug-resistant strains of several groups of microorganisms. Use of herbal products such as antimicrobial agents may provide the best alternative to the wide and injudicious use of synthetic antibiotics.

What has been done
The potential antimicrobial activities of sorrel (H. sabdariffa) were tested against food, veterinary, and clinical sources of E. coli O157:H7.

Results
Results showed that a 10% concentration of sorrel extract had the greatest inhibitory effect, but that the source of the samples was related to differential inhibition levels; the lowest mean inhibition was 7.00 ? 0.04 mm from clinical samples and the highest was 15.37 ? 0.61mm from a food source. These findings indicated that sorrel was effective at all levels in inhibiting E. coli O157:H7, suggested it possesses antimicrobial activity and holds great promise as an antimicrobial agent.

4. Associated Knowledge Areas

KA Code	Knowledge Area
721	Insects and Other Pests Affecting Humans
722	Zoonotic Diseases and Parasites Affecting Humans

Outcome #4

1. Outcome Measures

Research projects generate findings that impact the knowledge of prevention or curing of diseases influenced by interactions of genetics and the environment

2. Associated Institution Types

- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
722	Zoonotic Diseases and Parasites Affecting Humans
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Rapidly changing political, policy and economic conditions influence citizens' abilities to adapt to change while ensuring healthful living and high quality of life. Continued effects of the economy on federal, state and local support for research and extension programs continure to challenge our research and extension enterprises. Likewise, regulatory and other governmental policies and rules influence the educational and research capacities of our programs and our capacities to generate and provide new knowledge to help individuals, families and populations exist and prosper in a healthy, productive and satisfying environment. And in an environment and reduced funding, the program competition for existing funds becomes a greater challenge to manage. Nevertheless, emphasis is placed on those research and extension opportunities that have the greatest effect on sustainability citizens, families and businesses, i.e., economic, environmental and social and quality of life viability.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Information in this report is compled from North Carolina Cooperative Extension reporting system, faculty activity reports and impact statements, Office of Technology Transfer and the business offices at the two institutions. The data indicate that, despite continuing budget challenges, our research and extension programs continue to reach significant segments of our audience with relevant research and extension information that has benefit to their enterprises. Based on the impact statements, publications and patents filed, our research and extension faculty on the two campuses and across the state continue to foster and lead change.

Key Items of Evaluation

Research and extension programs are focused on the following:

1. Understanding the impediments to healthy living (diseases, environmental factors, vectors, nutrition, etc.) that might be mitigated by research solutions
2. Exploiting natural products that might play roles in enhancing nutrition, reducing diseases incidence or severity, enhancement of existing antibiotic or other disease treatment approaches
3. Discovering biobased materials that play a role in human nutrition
4. Breeding new plant lines or varieties that have nutraceutical value for enhancing

health